

Customer No.: 31561
Application No.: 10/710,199
Docket No.: 13875-US-PA-X

REMARKS

Present Status of the Application

The specification is objected to because the title is not descriptive and the abstract is not clearly indicative the invention to which the claims are directed. The Office Action rejected claims 14-17 and 19-20 under 35 U.S.C. 103(a) as being unpatentable over Eppich (US 2004/0178458) in view of Forbes (US 2005/0023602). The Office Action also rejected claim 18 under 35 U.S.C. 103(a) as being unpatentable over Eppich in view of Forbes.

Applicants have amended the title and the abstract to overcome the objections.

Applicants have amended claim 14 to more clearly define the present invention. After entry of the foregoing amendments, claims 14-20 remain pending in the present application, and reconsideration of those claims is respectfully requested.

Discussion of Office Action Objections

The title and the abstract are objected to. Applicants have amended the title into "MOS TRANSISTOR HAVING A WORK-FUNCTION DOMINATING LAYER" that is clearly indicative of the invention to which the claims are directed. Applicants have also amended the abstract in which a MOS transistor is described.

Rejection under 35 U.S.C 103 (a)

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Applicants respectfully traverse the rejection of claims 14-17 and 19-20 under 103(a) as being unpatentable over Eppich (US 2004/0178458) in view of Forbes (US 2005/0023602) because a prima facie case of obviousness has not been established by the Office Action.

The present invention is in general related a MOS transistor claim 14 recites:

14. A MOS transistor, comprising:
a substrate;
a gate dielectric layer on the substrate;
a stacked gate on the gate dielectric layer, comprising, from bottom to top, a first barrier layer, an interlayer, a work-function-dominating layer, a second barrier layer and a poly-Si layer, wherein the work-function-dominating layer comprises a metallic material; and
a source/drain in the substrate beside the gate.

To establish a prima facie case of obviousness under 35 U.S.C. 103(a), each of three requirements must be met. First, the reference or references, taken alone or combined, must teach or suggest each and every element in the claims. Second, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skilled in the art, to combine the references in a manner resulting in the claimed invention. Third, a reasonable expectation of success must exist. Moreover, each of the three requirements must "be found in the prior art, and not be based on applicant's disclosure." See M.P.E.P. 2143, 8th ed., February 2003.

Eppich fails to disclose, teach or suggest that the stacked gate comprises a work-function-dominating layer comprising a metallic material. In Eppich's reference, the PMOS transistor shown in Fig. 6 includes a dielectric layer 22, a gate stack 42 and a source/drain 52. In particular, the gate stack 42 is composed of a first metal containing layer 24, a second metal containing

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layer 30, a silicon containing layer 32 and a metal/metal alloy layer 34. The office action pointed out the silicon containing layer 32 is the work-function-dominating layer as claim 14 recited. However, the silicon containing layer 32 disclosed by Eppich consists essentially of conductivity-doped silicon (such as conductivity doped amorphous silicon or conductivity doped polycrystalline silicon) (see paragraph [0039]). But the work-function-dominating layer of claim 14 comprises a metallic material. The material of the work-function-dominating layer of the present invention is different from that of the silicon containing layer 32 disclosed by Eppich.

In addition, Eppich also describes the silicon of layer 32 which contacts the metal-containing layer 30 can react with the metal-containing material to form a composition comprising metal, silicon and possible nitrogen, at the interface of the silicon and the metal containing material. Such composition can have a work function intermediate that of a metal silicide and a metal containing material (see paragraph [0049]). However, in claim 14 of the present invention, the work-function-dominating layer is disposed on the interlayer. The work function of the work-function-dominating layer can be adjusted by the interlayer the interlayer. In details, the interlayer can be as a nucleation layer that is capable of controlling the crystal orientation of the work-function-dominating layer. Therefore, the work function of the work-function-dominating layer is not only dominated by its material and phase but also affected by its crystal orientation. The work function of the stacked gate of the present invention is not affected by a work function intermediate that of a metal silicide and a metal containing material.

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Moreover, Forbrs also fails to disclose, teach or suggest that the stacked gate comprises a work-function-dominating layer comprising a metallic material. The stacked gate disclosed by Forbrs includes a polysilicon floating gate 211, a metal layer 216, a metal oxide and/or low tunnel barrier interpoly insulator 215, another metal layer 217 and a polysilicon control gate 213. The layer between the two metal layers 216, 217 is a metal oxide and/or low tunnel barrier interpoly insulator 215 but not a work-function-dominating layer comprising a metallic material.

Therefore, the references combined do not teach or suggest each and every element in claim 14.

In addition, the office action pointed out Eppich does not teach the stacked gate comprises a poly-Si layer on the second barrier layer, but Forbrs teaches a poly-Si layer 213 on the second barrier layer 217. However, there is not any suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine the references in a manner resulting in the claimed invention.

When obviousness is based on the teachings of multiple prior art references, the movant must also establish some "suggestion, teaching, or motivation" that would have led a person of ordinary skill in the art to combine the relevant prior art teachings in the manner claimed. See *Tec Air, Inc. v. Denso Mfg. Mich. Inc.*, 192 F.3d 1353, 1359-60 (Fed. Cir. 1999); *Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc.*, 75 F.3d 1568, 1572 (Fed. Cir. 1996).

The nonmovant may rebut a prima facie showing of obviousness with evidence refuting the movant's case or with other objective evidence of nonobviousness. See *WMS Gaming, Inc. v. Int'l Game Tech.*, 184 F.3d 1339, 1359 (Fed. Cir. 1999).

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The aspect of the reference of Eppich is a recognition that it can be advantageous to incorporate a metal-containing material between dielectric material and conductivity-doped silicon in NMOS and PMOS devices for influencing the total work function of the gate stack. On the other hand, in reference of Forbes, asymmetrical low barrier tunnel insulator are formed between the floating gate and the control gate so as to avoid large barriers to electron tunneling or hot electron injection in programmable array type logic and/or memory devices. Therefore, there is not any "suggestion, teaching, or motivation" that would have led a person of ordinary skill in the art to combine the relevant prior art teachings in the manner claimed.

For at least the foregoing reasons, Applicants respectfully submit a prima facie case of obviousness has not been established by the Office Action. Independent claim 14 patently defines over the prior art references, and should be allowed. For at least the same reasons, dependent claims 15-17, 19-20 patently define over the prior art as a matter of law.

Applicants respectfully traverse the rejection of claim 18 under 103(a) as being unpatentable over Eppich (US 2004/0178458) in view of Forbes (US 2005/0023602) because a prima facie case of obviousness has not been established by the Office Action.

Applicants submit that, as disclosed above, Eppich and Forbes fail to teach or suggest each and every element of claim 14 from which claim 18 depends. Because a prima facie case of obviousness for claim 14 has not been established by the Office Action and should be allowed, its dependent claim 18 patently define over the prior art as a matter of law.

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CONCLUSION

For at least the foregoing reasons, it is believed that the pending claims are in proper condition for allowance. If the Examiner believes that a telephone conference would expedite the examination of the above-identified patent application, the Examiner is invited to call the undersigned.

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Respectfully submitted,

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